PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-355582
(43)Date of publication of application : 24.12.1999

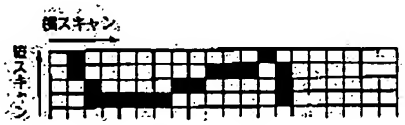
(51)Int.CI. H04N 1/41
H04N 1/411

(21)Application number : 10-161207
(22)Date of filing : 09.06.1998

(71)Applicant : MITSUBISHI ELECTRIC CORP
(72)Inventor : NISHIKAWA SHUICHI

(54) IMAGE ENCODING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To enhance compression ratio by dividing image data into plural blocks, scanning each block in a vertical direction and a horizontal direction, executing run length encoding, and adopting the code smaller in the amount of codes.
SOLUTION: The run length of the data after compression, is defined as 5-bit fixed length whose leading bit is white or black identifier and four bits are fixed. In the case of encoding one block consisting of the 4×4 pixel of an image, left/upper one block is scanned in a horizontal direction to execute horizontal direction encoding processing to count each run length. Next, scanning in a vertical direction is executed and vertical direction encoding processing is executed to count a white or black run length. The numbers of horizontal and vertical run lengths become 8 and 5 and data quantities become 40 bit and 25 bit. Consequently, vertical scanning of a small data quantity is used to encode one block. Continually, the block is moved to be similarly moved and these operation is executed extending the whole blocks. At the time of decoding, processing opposite to this is executed to restore to an original image.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] N (N is the natural number of arbitration) pixel and length width for the image data of M (M is the natural number of arbitration) pixel P (P is the natural number of arbitration smaller than N) pixel, [width] Longitudinal direction coding processing in which divide length into each block of Q (Q is the natural number of arbitration smaller than M) pixel, scan the inside of each they-divided block in a longitudinal direction, and run length coding is performed, Lengthwise direction coding processing in which scan the inside of each divided above-mentioned block to a lengthwise direction, and run length coding is performed, While measuring the amount of signs for every above-mentioned block in which run length coding was carried out by the above-mentioned longitudinal direction coding processing and the above-mentioned lengthwise direction coding processing and adopting the sign of the small amount of signs The image coding approach equipped with the adoption sign judging processing which adds the identifier of these longitudinal direction coding processing or lengthwise direction coding processing to the adopted sign.
[Claim 2] N (N is the natural number of arbitration) pixel and length the image data of M (M is the natural number of arbitration) pixel [width] Divide width into Pa (natural number of arbitration with Pa smaller than N) pixel, and length is divided into each block of Qa (natural number of arbitration with Qa smaller than M) pixel. The 1st longitudinal direction coding processing in which scan the inside of each block divided into these PaQa(s) pixel in a longitudinal direction, and run length coding is performed, The 1st lengthwise direction coding processing in which scan the inside of each above-mentioned block divided into the PaQa pixel to a lengthwise direction, and run length coding is performed, While measuring the amount of signs for every above-mentioned block in which run length coding was carried out by the above-mentioned 1st longitudinal direction coding processing and the above-mentioned 1st lengthwise direction coding processing and adopting the sign of the small amount of signs The 1st adoption sign judging processing which adds the identifier according to coding processing of these longitudinal directions or a lengthwise direction to the adopted sign, Width for the image data whose width is N pixel and whose length is M pixels Pb (natural number of arbitration with Pb smaller than N) pixel, It is Qb (Qb is the natural number of arbitration smaller than M in Pa!=Pb at least) about length. Or the 2nd longitudinal direction coding processing in which scan the inside of each block which divided into each block of a Qa!=Qb pixel and was divided into these PbQb(s) pixel in a longitudinal direction, and run length coding is performed, The 2nd lengthwise direction coding processing in which scan the inside of each above-mentioned block divided into the PbQb pixel to a lengthwise direction, and run length coding is performed, While measuring the amount of signs for every above-mentioned block in which run length coding was carried out by the above-mentioned 2nd longitudinal direction coding processing and the above-mentioned 2nd lengthwise direction coding processing and adopting the sign of the small amount of signs The 2nd adoption sign judging processing which adds the identifier according to coding processing of these longitudinal directions or a lengthwise direction to the adopted sign, While measuring the amount of signs adopted by the above-mentioned 1st adoption sign judging processing and the above-mentioned 2nd adoption sign judging processing and adopting the sign of the small amount of signs The image coding approach equipped with the 3rd adoption sign judging processing which adds the sign of the PaQa pixel

which carried out block division, or a PbQb pixel to the adopted sign.
[Claim 3] the run length who scans the image data whose length and breadth are the pixel of arbitration in the direction set up beforehand, and does counting in the run length of the same identifier -- counting -- processing and its run length -- counting -- the image coding approach equipped with the coding processing which performs run length coding when the run length of the identifier in which counting was carried out by processing differs from the setting identifier and the setting run length who were set up beforehand.
[Claim 4] The coding processing whose length and breadth scan the image data which is the pixel of arbitration in the direction set up beforehand, and perform run length coding, The sign of the identifier from which the plurality in which run length coding was carried out by the coding processing differs is made into a group. Compare the sign of the back group by which run length coding was carried out to the front group just behind that, and after that, when the run length of the sign of one identifier differs to a front group only in **K (K is the natural number of 0 or arbitration), a group The image coding approach equipped with the group sign creation processing which adds **K encoded to the identifier from which it replaces with the run length sign of a group after that, and the run length differs in a group after that.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the image coding approach which encodes an image.
[0002]
[Description of the Prior Art] As the conventional image coding approach, in the case of the binary image of white and black, binary-code-ize the run length of a white pixel or a black pixel, and this is divided into 2 bitwises, for example. By adding 1 bit of signs for distinguishing white or black to this When there is a thing using the sign train which made the triplet one group and the binary-code-ized run length becomes larger than 2 bits The approach of encoding a binary image is widely learned by making the group to whom the same monochrome distinction sign was attached continue, and expressing a run length with 4 bits or 6 bits. However, by this approach, only about the longitudinal direction of one line, since run length coding is carried out, the technical problem that compressibility does not become high occurs. Then, there is the image coding approach shown in JP,57-21901,B in order to cancel such a technical problem. In the image data N pixel and whose length of this approach width is M pixels [smaller than it] When divide width into P pixels, length is divided into a Q-pixel block, two or more standard patterns are prepared beforehand and it is in agreement with the pattern of an actual image, or the above-mentioned standard pattern When the sign showing which [of a standard pattern] it is is made and it is in agreement with neither of the above-mentioned standard pattern, the sign which expresses white or black as it is is made.
[0003]
[Problem(s) to be Solved by the Invention] Since it was the approach of dividing image data into the block of PQ pixel, and preparing two or more standard patterns beforehand, since the conventional image coding approach is constituted as mentioned above, the technical problem that the probability not to be in agreement with a standard pattern will become high if a large block is taken, and compressibility did not become high occurred. Moreover, although the probability which is in agreement with a standard pattern became high when the small block was taken, since the number of blocks increased, after all, the amount of signs increased and the technical problem that compressibility did not become high occurred.
[0004] It was made in order that this invention might solve the above technical problems, and it aims at acquiring the image coding approach which can make compressibility high.
[0005]
[Means for Solving the Problem] Longitudinal direction coding processing in which the image coding approach concerning this invention scans the inside of each divided block in a longitudinal direction, and run length coding is performed, While measuring the amount of signs for each [these / by which run length coding was carried out] the block of every with lengthwise direction coding processing in which scan the inside of each divided block to a lengthwise direction, and run length coding is performed and adopting the sign of the small amount of signs It has the adoption sign judging processing which adds the identifier of longitudinal direction coding processing or lengthwise direction coding processing to the adopted sign.
[0006] While the image coding approach concerning this invention measures the amount of signs for every block by which scanned the inside of each block divided into the PaQa pixel to the longitudinal direction and the lengthwise direction, and run length coding was carried out and adopting the sign of the small

amount of signs The 1st adoption sign judging processing which adds the identifier according to coding processing of a longitudinal direction or a lengthwise direction, While measuring the amount of signs for every block by which scanned the inside of each block divided into the PbQb pixel to the longitudinal direction and the lengthwise direction, and run length coding was carried out and adopting the sign of the small amount of signs While measuring the amount of signs adopted by the 2nd adoption sign judging processing which adds the identifier according to coding processing of a longitudinal direction or a lengthwise direction, and the 1st adoption sign judging processing and the 2nd adoption sign judging processing and adopting the sign of the small amount of signs It has the 3rd adoption sign judging processing which adds the sign of the PaQa pixel which carried out block division, or a PbQb pixel.
[0007] the run length who the image coding approach concerning this invention scans image data, and does counting of the run length of the same identifier -- counting -- when processing and the run length of that identifier by which counting was carried out differ from the setting identifier and setting run length who were set up beforehand, it has the coding processing which performs run length coding.
[0008] The coding processing which the image coding approach concerning this invention scans image data, and performs run length coding, The sign of the identifier from which the plurality by which run length coding was carried out differs is made into a group. It has group sign creation processing in which a back group adds **K encoded to the identifier from which it replaces with the run length sign of a group after that, and the run length differs in a group after that when the run length of the sign of one identifier differs to a front group only in **K.
[0009]
[Embodiment of the Invention] Hereafter, one gestalt of implementation of this invention is explained. Gestalt 1. drawing 1 of operation is the conceptual diagram showing the image of the road map used for a navigation system, and drawing 2 is the conceptual diagram showing the image to which the broken-line section of drawing 1 was expanded. Width is the case where it is the binary image of white and black N= 20 pixels and whose length of this drawing 2 are M pixels, and the magnitude of a block is P=Q and is explained by the case of 4x4 pixels. Drawing 3 is the conceptual diagram showing a code configuration, and, in the case of the 5-bit fixed-length sign of 4-bit immobilization of a monochrome identifier and run length, 1 bit of heads explains it.
[0010] Next, actuation is explained. Drawing 4 is a flow chart which shows the image coding approach by the gestalt 1 of implementation of this invention, and explains actuation based on this drawing 4 . First, 1-block coding which consists of 4x4 pixels of the image of drawing 2 is explained. 1 block at the upper left of the image of drawing 2 is scanned in a longitudinal direction (step ST-1: longitudinal direction coding processing), and white or black run length is counted. In this case, as for the 1st run length, white is set to 1 (step ST-2: longitudinal direction coding processing). The 2nd run length serves as black 1 similarly. the 3rd -- white -- although it is coming to the edge of a block by 2 -- the bottom of one step -- **** -- a Z twist, then run length are counted. The 3rd becomes white 3. 1 block of all run length is counted similarly. After a lateral scan is completed (step ST-3: longitudinal direction coding processing), a lengthwise direction is scanned (step ST-4: lengthwise direction coding processing), white or black run length is counted (step ST-5: lengthwise direction coding processing), and the scan of both directions is ended (step ST-6: lengthwise direction coding processing). Drawing 5 is the explanatory view showing the number of the run length of a horizontal scan and a vertical scan, the number of run length is 8 and 5, and since one data is a 5-bit fixed length, the amount of data becomes 40 bits and 25 bits. And the direction with little amount of data, a lengthwise direction scan is adopted in this case (step ST-7: adoption sign judging processing), and 1-block coding is performed (step ST-8: adoption sign judging processing). Drawing 6 is the conceptual diagram showing the encoded 1-block result for the run length data of drawing 5 by the code configuration of drawing 3 , in drawing 6 , adds the flag of a longitudinal direction or a lengthwise direction to 1 bit of a head, and serves as a 26-bit sign. After 1-block coding is completed, a block is moved to the right and it encodes similarly. A sign is continued that there is no break in the sign of a pre-block. Although drawing 7 is the conceptual diagram showing a sign when 5 blocks is completed and the run length of a block [5th] sign has become 0000 in drawing 7 , since run length cannot have 0, this is

interpreted as 16. The above actuation is performed over a whole block and coding of the image of a horizontal N pixel and M pixels long is completed.

[0011] On the other hand, in the direction to decode, processing contrary to this is performed and it restores to the original image. In drawing 7 , since 1 bit of heads of a sign is a flag in every direction, it or subsequent ones is restored to an image by 5 bitwises, and they go. When a restoration pixel amounts to 16 pixels, it is 1-block termination and the following 1 bit is the flag of the following block in every direction. It decodes like the following and a horizontal N pixel and a M pixels long image are restored.

[0012] In addition, with the gestalt 1 of the above-mentioned implementation, in order to simplify explanation, the monochrome identifier was added to the head of a sign and it considered as the sign of 5 bit patterns, but since white and black become by turns with the sign of the 2nd henceforth within a block, if a monochrome identifier is removed and it is the sign of 4 bit patterns, with the sign of the 2nd henceforth within a block, compressibility can be made high more. Moreover, with the gestalt 1 of the above-mentioned implementation, although run length was made into the 4-bit fixed length, entropy is calculated for this from the frequency of occurrence, and if a short sign is statistically made into the variable-length sign which assigns a long sign at the low thing of an appearance probability at the high thing of an appearance probability, compressibility can be made high more. Moreover, with the gestalt 1 of the above-mentioned implementation, although the binary image of white and black explained, even if this is the image of halftone with gradation, and the image of a color, it can carry out similarly. Drawing 8 is the conceptual diagram showing the color picture which expanded the broken-line section of drawing 1 , and is the case where it is the color picture whose width is N= 20 pixels and whose length is M pixels. The magnitude of a block is P=Q and is the case of 4x4 pixels. Drawing 9 is the conceptual diagram showing a code configuration, and a top triplet is the identifier of a color and it is the case of the color of eight colors in this example. Similarly a top triplet and the relation of a color are shown in drawing 9 . Run length is the 7-bit fixed-length sign of 4-bit immobilization. Moreover, in the case of a halftone image, a top color identifier should just be changed into a gradation identifier.

[0013] As mentioned above, with the gestalt 1 of this operation, since divided image data into the block, scanned the inside of that block to the longitudinal direction and the lengthwise direction, performed run length coding one by one, the one where the amount of signs is smaller was adopted, the flag of a longitudinal direction scan and a lengthwise direction scan was added and it considered as the sign, compressibility can be made high.

[0014] gestalt 2. of operation -- the gestalt 2 of this operation asks for the block division to which the amount of signs of image data serves as min in the gestalt 1 of operation.

[0015] Next, actuation is explained. Drawing 10 is a flow chart which shows the image coding approach by the gestalt 2 of this operation, and explains actuation based on this drawing 10 . As shown in drawing 2 , it considers as the binary image of white and black whose width is N= 20 pixels and whose length is M pixels. Moreover, with the gestalt 2 of this operation, the magnitude of a block shall be Pa=Qa and shall measure the amount of signs at the time of making it a 2x2-pixel block, and the amount of signs at the time of being Pb=Qb (Pa!=Pb, Qa!=Qb) and making it a 4x4-pixel block. Drawing 11 is the conceptual diagram showing the code configuration at the time of making it a 2x2-pixel block, and, in the case of the triplet fixed-length sign of 2-bit immobilization of a monochrome identifier and run length, 1 bit of heads explains it. First, coding at the time of making it a 2x2-pixel block is performed (step ST-11: the 1st longitudinal direction coding processing, the 1st lengthwise direction coding processing, the 1st adoption sign judging processing). The approach of coding is as the gestalt 1 of operation having explained. In the block 2x2 pixels at the upper left of the image of drawing 2 , since there are few amounts of signs, a flag in every direction is set to 1, and the directions of a lengthwise direction scan are white 2 and black 2. Coding to 20 blocks is performed like the following. Drawing 12 is the conceptual diagram showing a sign when a 2x2-pixel block is completed. Next, coding at the time of making it a 4x4-pixel block is performed (step ST-12: the 2nd longitudinal direction coding processing, the 2nd lengthwise direction coding processing, the 2nd adoption sign judging processing). This is as the gestalt 1 of operation having explained. The result of having performed coding to 5 blocks to drawing 7 is shown. The amount of signs at the time of making

it a 2x2-pixel block here and the amount of signs at the time of making it a 4x4-pixel block are measured. The amount of signs at the time of making it a 2x2-pixel block is 113 bits, and the amount of signs at the time of making it a 4x4-pixel block is 80 bits. Then, the sign at the time of making it a 4x4-pixel block is adopted (step ST-13: the 3rd adoption sign judging processing). Drawing 13 is the conceptual diagram showing PaQa or PbQb added to a sign, in the above-mentioned case, the sign of 4x4 of drawing 13 is added to a head, and it continues the sign of drawing 7 . The above actuation is performed over a whole block and coding of the image of a horizontal N pixel and M pixels long is completed.

[0016] In addition, although the gestalt 2 of the above-mentioned implementation described how to add PaQa or PbQb for every stage beside the block of the larger one, by the horizontal N pixel and the M pixels long image, one PaQa or PbQb may be added and PaQa or PbQb may be added for every stage of two or more width. Moreover, although image data should be divided into the block (2x2 pixels and 4x4 pixels), image data may be divided into the block of the pixel x pixel of arbitration, and you may make it adopt further the one where the amount of signs is smaller with the gestalt 2 of the above-mentioned implementation from what was divided into the block of the pixel x pixel of three or more kinds of different arbitration.

[0017] As mentioned above, image data is divided into a 2x2-pixel block with the gestalt 2 of this operation. Scan the inside of the block to a longitudinal direction and a lengthwise direction, and run length coding is performed one by one. Adopt the one where the amount of signs is smaller, add the flag of a longitudinal direction scan and a lengthwise direction scan, and it considers as a sign. Moreover, divide image data into a 4x4-pixel block, scan the inside of the block to a longitudinal direction and a lengthwise direction, and run length coding is performed one by one. Adopt the one where the amount of signs is smaller, add the flag of a longitudinal direction scan and a lengthwise direction scan, and it considers as a sign. The one where the amount of signs by 2x2-pixel block and the amount of signs by 4x4-pixel block are finally smaller is adopted, and since the sign which shows block division (2x2 pixels or 4x4 pixels) was added, compressibility can be made high.

[0018] gestalt 3. of operation -- when the pixel of the identifier beforehand set as black and white, the gradation, or the color identifier in a sign train exists by the die length set up beforehand, run length coding of the gestalt 3 of this operation is not carried out, but it is restored so that the pixel of the identifier beforehand set up on the occasion of a decryption may exist by the die length set up beforehand.

[0019] Next, actuation is explained. Drawing 14 is a flow chart which shows the image coding approach by the gestalt 3 of this operation, and explains actuation based on this drawing 14 . Here, let the pixel of the setting identifier set up beforehand be black. Moreover, the setting run length set up beforehand is set to 1. The case where it is the binary image of white and black whose width is N= 20 pixels and whose length is M pixels is shown in drawing 2 . Width shall be divided into P pixels, length shall be divided into a Q-pixel block, and the magnitude of a block is P=Q and is explained by the case of 4x4 pixels. The direction of a scan is considered only as a horizontal scan in this case. A code configuration is shown in drawing 3 . In the case of the 5-bit fixed-length sign of 4-bit immobilization of the identifier of black and white 1 bit of heads, and run length, it explains. 1 block at the upper left of the image of drawing 2 is scanned in a longitudinal direction (21: step ST- run length counting processing), and white or black run length is counted. As for the 1st run length, white is set to 1 in drawing 2 (22: step ST- run length counting processing). Next, it investigates whether it is the setting run length by whom the pixel of the setting identifier set up beforehand was set up beforehand. Here, since black 1 is set up beforehand, white 1 serves as No by (Step ST-23: Coding processing), and performs run length coding (step ST-24: coding processing). Similarly, the 2nd run length serves as black 1, and does not encode by being set to Yes by (Step ST-23: Coding processing). 1 block of all coding is performed similarly. Drawing 15 (a) is the conceptual diagram showing a sign when 1 block is completed. Moreover, drawing 15 (b) is the conceptual diagram showing the sign in the conventional approach. After 1-block coding is completed, a block is moved to the right and it encodes similarly. A sign is continued that there is no break in the sign of a pre-block. The above actuation is performed over a whole block and coding of the image of a horizontal N pixel and M pixels long is completed.

[0020] In the direction to decode, processing contrary to this is performed and it restores to the original image. In drawing 15 , from a head, it restores to an image and goes by 5 bitwises. When the same identifier continues at this time, since the identifier of the 1st, the 2nd, the 2nd, the 3rd, the 3rd, and the 4th sign is white, in this example both, it restores as what has black 1 between each. When a restoration pixel amounts to 16 pixels, it is 1-block termination. It decodes like the following and a horizontal N pixel and a M pixels long image are restored.

[0021] In addition, with the gestalt 3 of the above-mentioned implementation, although run length was made into the 4-bit fixed length, entropy is calculated for this from the frequency of occurrence, and if a short sign is statistically made into the variable-length sign which assigns a long sign at the low thing of an appearance probability at the high thing of an appearance probability, compressibility can be made high more. Moreover, with the gestalt 3 of the above-mentioned implementation, although the binary image of white and black explained, even if this is the image of halftone with gradation, and the image of a color, it can carry out similarly.

[0022] As mentioned above, with the gestalt 3 of this operation, since run length coding is not carried out when the pixel of the identifier beforehand set as black and white, the gradation, or the color identifier in a sign train exists by the die length set up beforehand, compressibility can be made high.

[0023] The gestalt 4 of this operation makes a group the run length sign of the identifier from which plurality differs. gestalt 4. of operation -- The sign of the back group by which run length coding was carried out to the front group just behind that is compared. **K which the group encoded after that to the identifier from which it replaces with the run length sign of a group after that, and the run length differs in a group after that when the run length of the sign of one identifier differed to a front group only in **K is added.

[0024] Next, actuation is explained. Drawing 16 is a flow chart which shows the image coding approach by the gestalt 4 of this operation, and explains actuation based on this drawing 16 . The case where it is the binary image of white and black whose width is N= 20 pixels and whose length is M pixels is shown in drawing 2 . Width shall be divided into P pixels, length shall be divided into a Q-pixel block, and the magnitude of a block is P=Q and is explained by the case of 4x4 pixels. The direction of a scan is considered only as a horizontal scan. Two run length signs shall be made into a group. Drawing 17 is the conceptual diagram showing a code configuration, and 1 bit of heads is the discernment flag of the usual run length sign and group information. The case of a run length sign is shown in drawing 17 (a). The 2nd bit considers as the 6-bit fixed-length sign of 4-bit immobilization of a monochrome identifier and run length. Moreover, the case of group information is shown in drawing 17 (b). The sign from which run length differs [the 2nd bit] **K is the identifier of the sign in front of a group, and a next sign. Expressing **K with 4-bit immobilization, therefore, the range is -8 to +7. The case of a 6-bit fixed-length sign is explained to an example on the whole. 1 block at the upper left of the image of drawing 2 is scanned in a longitudinal direction, and coding of white or black is performed (step ST-31: coding processing). Drawing 18 is the conceptual diagram showing a sign when 1 block is completed. In drawing 2 , since it is white 1, it becomes a 6-bit sign from the head of drawing 18 . Since it is next black 1, it becomes a sign from the 7th bit to [from the head of drawing 18] 12 bits (step ST-32: coding processing). Since it is not 1-block termination, it progresses to a degree (step ST-33: coding processing). Front groups are white 3 and black 1 to white 1 and black 1, since only +2 differs (step ST-34: group sign creation processing), white run length serves as Yes, and the following group creates group information (step ST-35: group sign creation processing). Group information becomes a sign from the 13th bit to [from the head of drawing 18] 18 bits. 1 block of all coding is performed similarly. After 1-block coding is completed, a block is moved to the right and it encodes similarly. A sign is continued that there is no break in the sign of a pre-block. The above actuation is performed over a whole block and coding of the image of a horizontal N pixel and M pixels long is completed.

[0025] In the direction to decode, processing contrary to this is performed and it restores to the original image. In drawing 18 , from a head, it restores to an image and goes by 6 bitwises. Since the group flag of the 3rd sign is 1 after decoding 1 pixel of whites, and 1 pixel of black, it turns out that it is group

information. The order flag has become the "front" by 0, and since **K are +2, they become white 3 and black 1. When a restoration pixel amounts to 16 pixels, it is 1-block termination. It decodes like the following and a horizontal N pixel and a M pixels long image are restored.

[0026] In addition, with the gestalt 4 of the above-mentioned implementation, in order to simplify explanation, although the identifier of black and white [bit / 2nd] of a sign was added and being considered as the sign of 6 bit patterns, since white and black become by turns with the run length sign of the 2nd henceforth within a block, if a monochrome identifier is removed and it is the sign of 5 bit patterns, by the run length sign of the 2nd henceforth within a block, compressibility can be made high more. Moreover, with the gestalt 4 of the above-mentioned implementation, although run length was made into the 4-bit fixed length, entropy is calculated for this from the frequency of occurrence, and if a short sign is statistically made into the variable-length sign which assigns a long sign at the low thing of an appearance probability at the high thing of an appearance probability, compressibility can be made high more. Moreover, with the gestalt 4 of the above-mentioned implementation, although the binary image of white and black explained, even if this is the image of halftone with gradation, and the image of a color, it can carry out similarly.

[0027] In addition, although the gestalt of operation mentioned above explained independently, respectively, if combination of the gestalt 1 of operation and the gestalt 3 of operation, combination of the gestalt 1 of operation and the gestalt 4 of operation, combination of the gestalt 3 of operation and the gestalt 4 of operation, and combination of the gestalt 1 of operation, the gestalt 3 of operation, and the gestalt 4 of operation are performed, compressibility can be made high more.

[0028] As mentioned above, with the gestalt 4 of this operation, the run length sign of the identifier from which plurality differs is made into a group. The sign of the back group by which run length coding was carried out to the front group just behind that is compared. Since **K which the group encoded after that to the identifier from which it replaces with the run length sign of a group after that, and the run length differs in a group after that when the run length of the sign of one identifier differed to a front group only in **K is added, compressibility can be made high.

[0029] Drawing 19 is the explanatory view showing the effectiveness by the gestalt 1 of implementation of this invention, the magnitude of an image carries out block division and N= 352 pixels wide, M= 288 pixels long, and gradation level indicate each amount of signs the case of the former of only a horizontal scan, and in the case of the gestalt 1 of operation to be the case of the former which is white, whitish ashes, blackish ashes, and a halftone image with 4 actual black gradation, and does not carry out block division. An image is a map image, Image A is a comparatively easy image and Images B are usually the image of extent, and an image with comparatively complicated Image C. QP of a block in every direction calculates 16 pixels, both code length calculates entropy from the frequency of occurrence, and it is the variable-length sign which assigns a long sign to the high thing of an appearance probability for a short sign at the low thing of an appearance probability statistically. Only compared with the horizontal scan of block division, there are few amounts of an average of 20% signs with the gestalt 1 of implementation of a scan in every direction so that clearly from drawing 19 . Drawing 20 is the explanatory view showing the effectiveness by the gestalt 2 of implementation of this invention, and shows the amount of signs at the time of setting magnitude of a block to 8x8, 16x16, and 32x32 with the gestalt 2 of operation. One PaQa is added by the horizontal N pixel and the M pixels long image. The magnitude of an image and gradation level, and code length are the same as the case of drawing 19 . By Image A, 32x32 is the optimal and it turns out in Image B and Image C that 16x16 is the optimal. Drawing 21 is the explanatory view showing the effectiveness by the gestalt 3 of implementation of this invention, and shows the amount of signs the case of only a horizontal scan of block division, and in the case of the gestalt 3 of operation. The magnitude of an image and gradation level, code length, and the magnitude of a block are the same as the case of drawing 19 . The identifier decided beforehand is the white in 4 gradation, and the die length of the pixel decided beforehand is 1 pixel. There are few amounts of an average of 18% signs. Drawing 22 is the explanatory view showing the effectiveness by the gestalt 4 of implementation of this invention, and shows the amount of signs the case of the gestalt 1 of operation, and at the time of combining the gestalt 4 of

operation with the gestalt 1 of operation. The magnitude of an image and gradation level, code length, and the magnitude of a block are the same as the case of drawing 19 . The group of a sign is 2 and **K is 1. With the gestalt 4 of operation, there are few amounts of an average of 5% signs. Drawing 23 is the explanatory view showing the effectiveness at the time of combining the gestalt 1 of implementation of this invention, the gestalt 3 of operation, and the gestalt 4 of operation, and block division is carried out and it indicates the amount of signs the case of the former of only a horizontal scan, and at the time of combining the gestalt 1 of operation, the gestalt 3 of operation, and the gestalt 4 of operation to be the case of the former which does not carry out block division. The magnitude of an image and gradation level, code length, and the magnitude of a block are the same as the case of drawing 19 . Block division is carried out and there are few amounts of an average of 33% signs compared with the case of the former of only a horizontal scan in the combination of the gestalt 1 of operation, the gestalt 3 of operation, and the gestalt 4 of operation.

[0030]

[Effect of the Invention] As mentioned above, since according to this invention divided image data into the block, and scanned the inside of that block to the longitudinal direction and the lengthwise direction, run length coding was performed, the one where the amount of signs is smaller was adopted and the identifier according to coding processing of a longitudinal direction or a lengthwise direction was added to that adopted sign, there is effectiveness which can make compressibility high.

[0031] According to this invention, image data is divided into the block of a PaQa pixel. Scan the inside of the block to a longitudinal direction and a lengthwise direction, and run length coding is performed. Adopt the one where the amount of signs is smaller, and the identifier according to coding processing of a longitudinal direction or a lengthwise direction is added to the adopted sign. Moreover, divide image data into the block of a PbQb pixel, scan the inside of the block to a longitudinal direction and a lengthwise direction, and run length coding is performed. Adopt the one where the amount of signs is smaller, and the identifier according to coding processing of a longitudinal direction or a lengthwise direction is added to the adopted sign. Furthermore, the one where the amount of signs by the block of a PaQa pixel and the amount of signs by the block of a PbQb pixel are finally smaller is adopted, and since the sign which shows block division of a PaQa pixel or a PbQb pixel was added, there is effectiveness which can make compressibility high.

[0032] according to this invention -- run length -- counting -- since it was made to perform run length coding when the run length of the identifier in which counting was carried out by processing differed from the setting identifier and setting run length who were set up beforehand, there is effectiveness which can make compressibility high.

[0033] According to this invention, the run length sign of the identifier from which plurality differs is made into a group. The sign of the back group by which run length coding was carried out to the front group just behind that is compared. It is effective in the ability to make compressibility high, since a group adds **K encoded to the identifier from which it replaces with the run length sign of a group after that, and the run length differs in a group after that when the run length of the sign of one identifier differs to a front group only in **K after that.

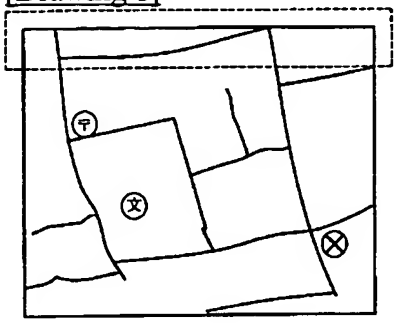
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

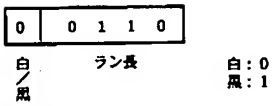
DRAWINGS

[Drawing 1]



[Drawing 2]

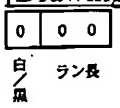
[Drawing 3]



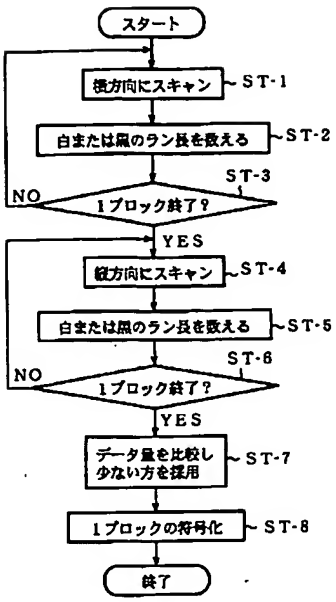
[Drawing 5]

スキャン方向	ラン長	ラン長の数	符号量
横スキャン	白1、黒1、白3、黒1、白4、黒1、白3、黒2	8	40ビット
縦スキャン	白6、黒4、白2、黒1、白3	5	25ビット

[Drawing 11]

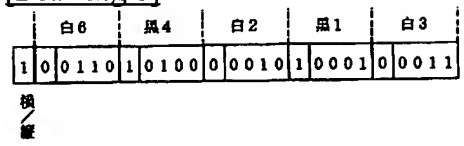


[Drawing 4]



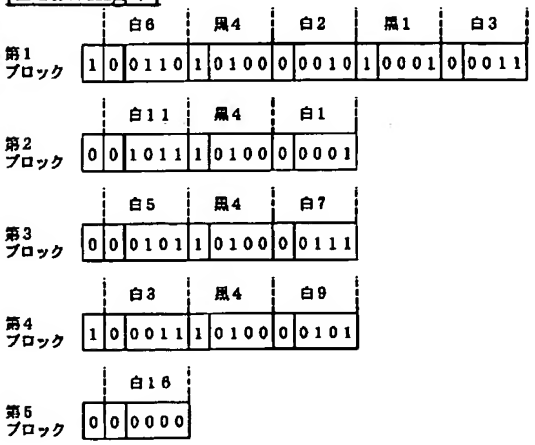
ST-1～ST-3：横方向符号化処理
ST-4～ST-6：縦方向符号化処理
ST-7，ST-8：採用符号判定処理

[Drawing 6]

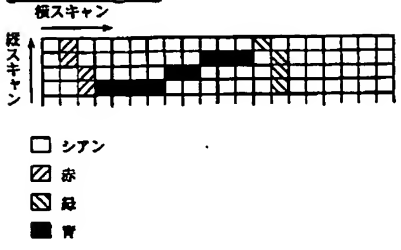


横：0
縦：1

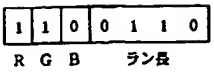
[Drawing 7]



[Drawing 8]

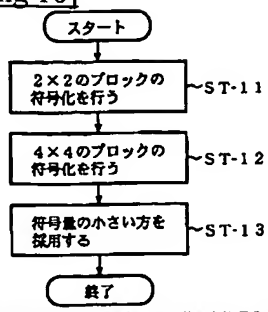


[Drawing 9]



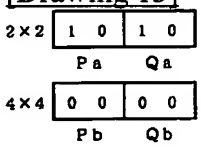
RGB
000：黒
001：青
010：緑
100：赤
011：シアン
110：黄
101：マゼンタ
111：白

[Drawing 10]

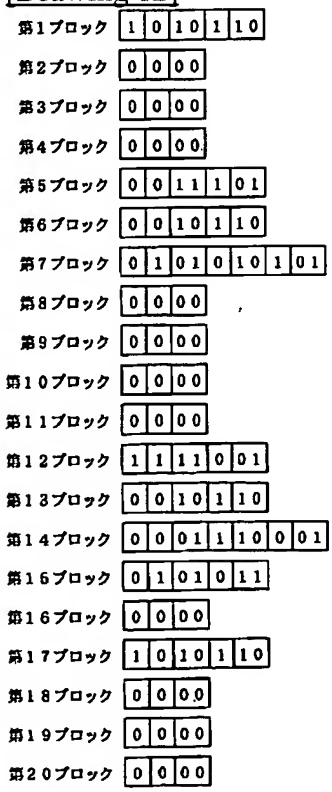


ST-11：第1横方向符号化処理、第1縦方向符号化処理
第1採用符号判定処理
ST-12：第2横方向符号化処理、第2縦方向符号化処理
第2採用符号判定処理
ST-13：第3採用符号判定処理

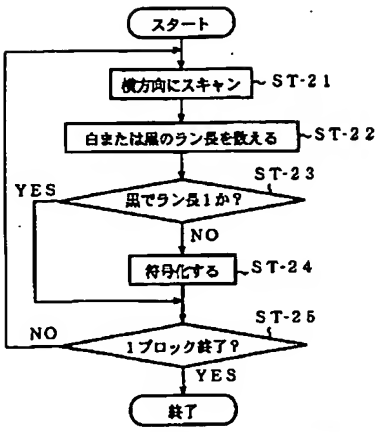
[Drawing 13]



[Drawing 12]



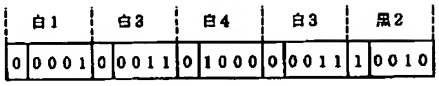
[Drawing 14]



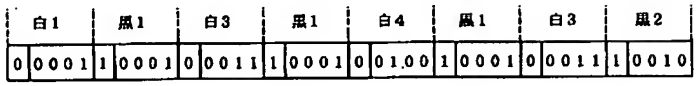
ST-21, ST-22 : ラン長計数処理
ST-23, ST-24 : 符号化処理

[Drawing 15]

(a)

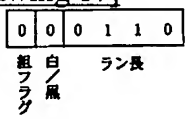


(b)

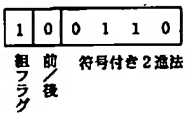


[Drawing 17]

(a)

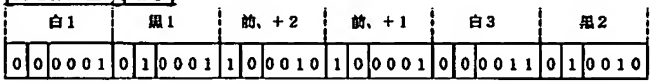


(b)



前 : 0
後 : 1

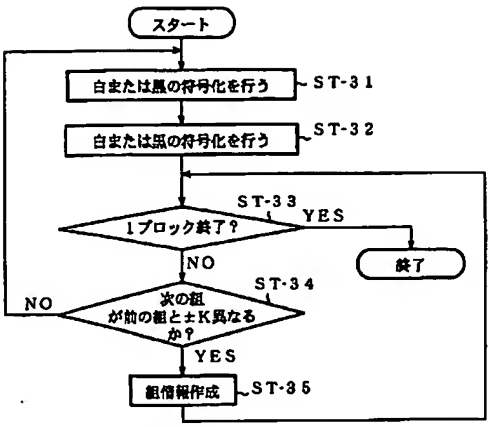
[Drawing 18]



[Drawing 20]

画像の種類	8×8	16×16	32×32
画像A	769バイト	488バイト	371バイト
画像B	2, 976バイト	2, 435バイト	2, 527バイト
画像C	6, 917バイト	6, 730バイト	7, 199バイト

[Drawing 16]



ST-31～ST-33：符号化処理
ST-34，ST-35：組符号作成処理

[Drawing 19]

画像の種類	ブロック分割なし	ブロック分割 横スキャンのみ	実施の形態1 縦横スキャン
画像A	745バイト	489バイト	488バイト
画像B	3，847バイト	3，416バイト	2，435バイト
画像C	8，377バイト	8，147バイト	6，730バイト
合計	12，969バイト	12，052バイト	9，653バイト
比	1．076	1．0	0．800

[Drawing 21]

画像の種類	ブロック分割 横スキャンのみ	実施の形態3
画像A	489バイト	369バイト
画像B	3，416バイト	2，819バイト
画像C	8，147バイト	6，894バイト
合計	12，052バイト	9，909バイト
比	1．0	0．822

[Drawing 22]

画像の種類	実施の形態1	実施の形態1＋実施の形態4
画像A	488バイト	452バイト
画像B	2，435バイト	2，282バイト
画像C	6，730バイト	6，451バイト
合計	9，653バイト	9，186バイト
比	1．0	0．951

[Drawing 23]

画像の種類	ブロック分割なし	ブロック分割 横スキャンのみ	実施の形態 1＋3＋4
画像A	745バイト	489バイト	392バイト
画像B	3，847バイト	3，416バイト	2，133バイト
画像C	8，377バイト	8，147バイト	5，613バイト
合計	12，969バイト	12，052バイト	8，138バイト
比	1．076	1．0	0．675

[Translation done.]